

What is claimed is:

1. A fuel pressure regulator for an internal combustion engine comprising:

5 a housing having a fuel inlet and a fuel outlet, the fuel inlet being adapted to connect with a fuel delivery pipe through which fuel pumped out of a fuel tank is delivered to an internal combustion engine, the fuel outlet adapted to connect with the fuel tank;

a seat member disposed within said housing, said seat  
10 member having a flow path formed therein, a seat opening, and a valve seat formed around the seat opening, the flow path allowing the fuel to flow from the fuel inlet to the fuel outlet of said housing and leading to the seat opening;

a valve member disposed within said housing downstream of  
15 the valve seat of said seat member in a flow of the fuel through the flow path of said valve member, said valve member being adapted to abut on the valve seat to close the seat opening and to be moved upon application of pressure of the fuel flowing through the flow path of said seat member to open the seat opening for regulating the  
20 pressure of the fuel delivered to the internal combustion engine; and

an urging member working to urge said valve member into abutment with the valve seat to close the seat opening of said seat member.

25 2. A fuel pressure regulator as set forth in claim 1, wherein said urging member is implemented by a plate spring which has an outer

periphery retained by said housing.

3. A fuel pressure regulator as set forth in claim 2, wherein said plate spring has an opening which establishes a fluid

5 communication between the seat opening of said seat member and the fuel tank.

4. A fuel pressure regulator as set forth in claim 1, wherein said urging member works to hold the valve member within said housing.

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5. A fuel pressure regulator as set forth in claim 2, wherein the plate spring is retained by a crimped portion of said housing.

6. A fuel pressure regulator for an internal combustion engine  
15 comprising:

a housing having a fuel outlet adapted to connect with a fuel tank;

a seat member having a fuel inlet, a seat opening, and a valve seat formed around the seat opening, the fuel inlet being adapted to  
20 connect with a fuel delivery pipe through which fuel pumped out of the fuel tank is delivered to an internal combustion engine, the seat opening establishing a fluid communication between the fuel inlet and the fuel outlet of said housing;

a valve member disposed between the valve seat of said seat  
25 member and the fuel outlet of said housing, said valve member being adapted to abut on the valve seat to close the seat opening and to be

moved upon application of pressure of the fuel thereto to open the seat opening for regulating the pressure of the fuel delivered to the internal combustion engine; and

an urging member disposed at the fuel outlet of said housing  
5 to urge said valve member into abutment with the valve seat to close the seat opening of said seat member.

7. A fuel pressure regulator as set forth in claim 6, wherein said urging member is implemented by a plate spring which has an outer  
10 periphery retained by said housing.

8. A fuel pressure regulator as set forth in claim 7, wherein said plate spring has an opening which establishes a fluid  
communication between the seat opening of said seat member and  
15 the fuel tank.

9. A fuel pressure regulator as set forth in claim 6, wherein said urging member works to hold the valve member within said housing.

20 10. A fuel pressure regulator as set forth in claim 7, wherein the plate spring is retained by a crimped portion of said housing.

11. A fuel pressure regulator for an internal combustion engine comprising:

25 a seat member a seat opening, and a valve seat formed around the seat opening, the seat opening leading to a fuel delivery

pipe through which fuel pumped out of a fuel tank is delivered to an internal combustion engine;

a valve member disposed downstream of the valve seat of said seat member in a flow of the fuel, said valve member being adapted  
5 to abut on the valve seat to close the seat opening and to be moved upon application of pressure of the fuel thereto to open the seat opening for regulating the pressure of the fuel delivered to the internal combustion engine; and

a plate spring working to urge said valve member into  
10 abutment with the valve seat to close the seat opening of said seat member, said plate spring including an outer portion retained to be stationary, an inner portion retained to be movable, at least one annular portion retained between the outer portion and the inner portion, and an outside and an inside joint portions, the outside  
15 joint portion connecting the outer portion and the annular portion, the inside joint portion connecting the annular portion and the inner portion, the outside and inside joint portions being opposed diametrically to each other across the center of the plate spring.

20 12. A fuel pressure regulator as set forth in claim 11, wherein said valve member is in abutment with the inner portion of said plate spring so as to be movable in a direction substantially perpendicular to a line extending in a thickness-wise direction of said plate spring.

25 13. A fuel pressure regulator as set forth in claim 11, further comprising a second annular portion disposed between said annular

portion and the outer portion, said second annular portion being greater in rigidity than said annular portion.

14. A fuel pressure regulator for an internal combustion engine  
5 comprising:

a seat member a seat opening, and a valve seat formed around the seat opening, the seat opening leading to a fuel delivery pipe through which fuel pumped out of a fuel tank is delivered to an internal combustion engine; and

10 a plate spring disposed downstream of the valve seat of said seat member in a flow of the fuel, said plate spring including an outer portion retained to be stationary, an inner portion retained to be movable, at least one annular portion retained between the outer portion and the inner portion, and an outside and an inside joint  
15 portions, the inner portion being adapted to abut on the valve seat to close the seat opening and to be moved upon application of pressure of the fuel thereto to open the seat opening for regulating the pressure of the fuel delivered to the internal combustion engine, the outside joint portion connecting the outer portion and the annular  
20 portion, the inside joint portion connecting the annular portion and the inner portion, the outside and inside joint portions being opposed diametrically to each other across the center of the plate spring.

25 15. A fuel pressure regulator as set forth in claim 14, further comprising a second annular portion disposed between said annular

portion and the outer portion, said second annular portion being greater in rigidity than said annular portion.

16. A fuel pressure regulator for an internal combustion engine  
5 comprising:

a seat member a seat opening, and a valve seat formed around the seat opening, the seat opening leading to a fuel delivery pipe through which fuel pumped out of a fuel tank is delivered to an internal combustion engine;

10 a valve member disposed downstream of the valve seat of said seat member in a flow of the fuel, said valve member being adapted to abut on the valve seat to close the seat opening and to be moved upon application of pressure of the fuel thereto to open the seat opening for regulating the pressure of the fuel delivered to the  
15 internal combustion engine; and

a plate spring working to urge said valve member into abutment with the valve seat to close the seat opening of said seat member, said plate spring including an outer portion retained to be stationary, a center portion abutting said valve member and  
20 retained to be movable, and at least two spring portions retained between the outer portion and the center portion, each of the spring portions having a first end joined to the outer portion and a second end joined to the center portion, the second ends being joined to an outer periphery of the center portion at equi-angular intervals.

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17. A fuel pressure regulator as set forth in claim as set forth in

claim 16, wherein said valve member is in abutment with the center portion of said plate spring so as to be movable in a direction substantially perpendicular to a line extending in a thickness-wise direction of the center portion.

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18. A fuel pressure regular as set forth in claim 16, wherein the spring portions of said plate spring are of a zigzag shape.

19. A fuel pressure regulator as set forth in claim 16, wherein the  
10 spring portions of said plate spring are of a spiral shape.

20. A fuel pressure regulator as set forth in claim 16, wherein each of said spring portions has rigidity which increases from the second end to the first end.

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21. A fuel pressure regulator for an internal combustion engine comprising:

a seat member a seat opening, and a valve seat formed around the seat opening, the seat opening leading to a fuel delivery  
20 pipe through which fuel pumped out of a fuel tank is delivered to an internal combustion engine; and

a plate spring disposed downstream of the valve seat of said seat member in a flow of the fuel, said plate spring including an outer portion retained to be stationary, a center portion adapted to  
25 abut on the valve seat to close the seat opening of said seat member and retained to be movable, and at least two spring portions retained

between the outer portion and the center portion, each of the spring portions having a first end joined to the outer portion and a second end joined to the center portion, the second ends being joined to an outer periphery of the center portion at equi-angular intervals.

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22. A fuel pressure regular as set forth in claim 21, wherein the spring portions of said plate spring are of a zigzag shape.

23. A fuel pressure regulator as set forth in claim 21, wherein the  
10 spring portions of said plate spring are of a spiral shape.

24. A fuel pressure regulator as set forth in claim 21, wherein each of said spring portions has rigidity which increases from the second end to the first end.

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